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(30)Priority

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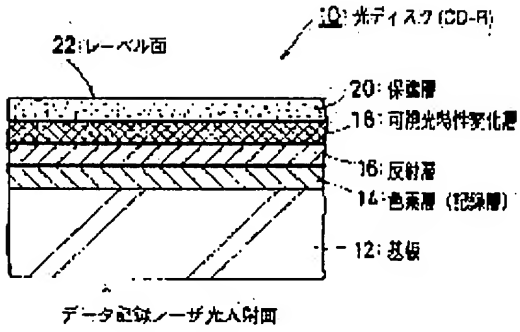
(54) IMAGE FORMING METHOD ON LABEL SURFACE OF OPTICAL DISK, OPTICAL DISK DEVICE AND OPTICAL DISK

(57)Abstract:

PROBLEM TO BE SOLVED: To form an image on a label surface of an optical disk utilizing a laser beam of an optical disk device.

SOLUTION: A visible light characteristics variation layer consisting of a photosensitive material, a thermosensitive material or the like is formed at the part which can be viewed from the side of the label surface of the optical disk. The optical disk is set to a turntable of the optical disk device turning the label surface downward. The optical disk and an optical pickup are relatively moved along the surface of the optical disk. The power of the laser beam emitted from the optical pickup synchronizing with the relative movement is modulated corresponding to image data of a character, picture and the like to be image-formed to irradiate the visible light characteristics variation layer with the laser beam. The visible light characteristics of the visible light characteristics change layer is varied by the laser beam irradiation to form the corresponding image on the label surface.



LEGAL STATUS

[Date of request for examination]	15.11.2002
[Date of sending the examiner's decision of rejection]	
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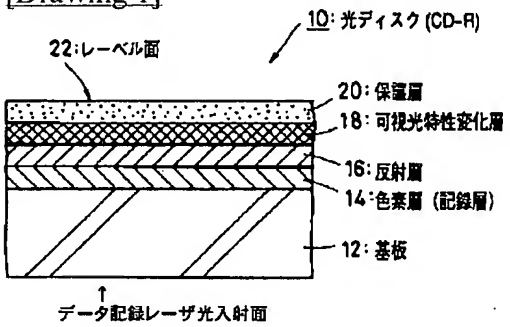
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

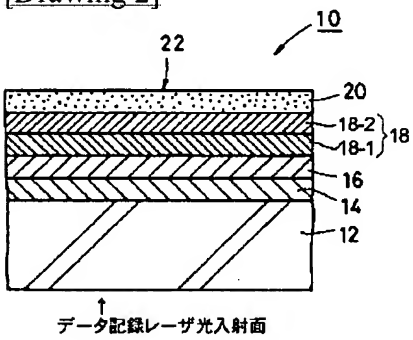
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

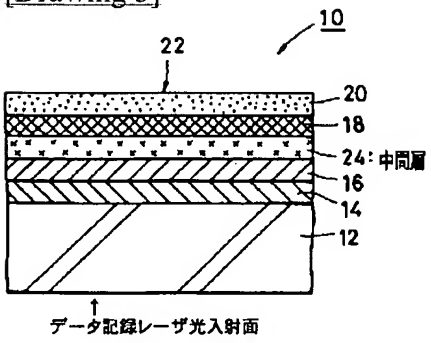
[Drawing 1]



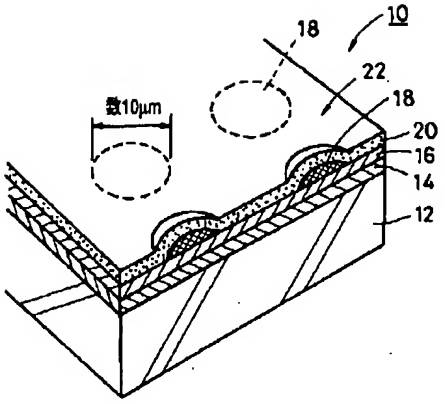
[Drawing 2]



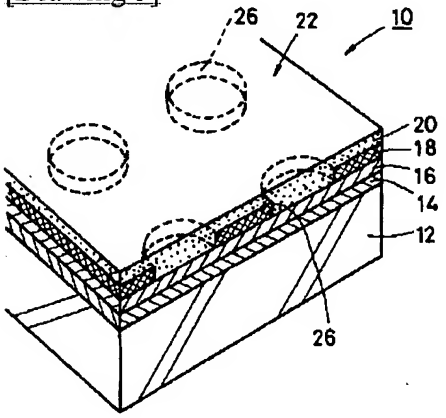
[Drawing 3]



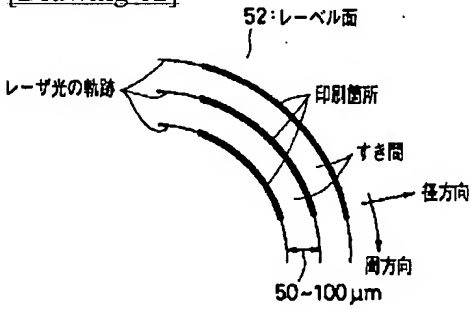
[Drawing 4]



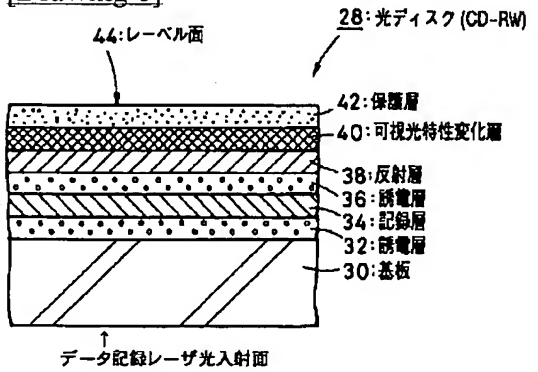
[Drawing 5]



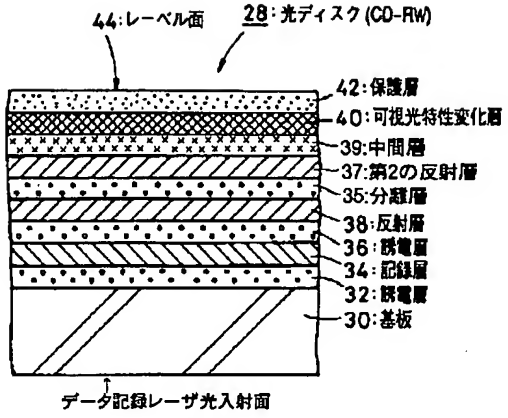
[Drawing 12]



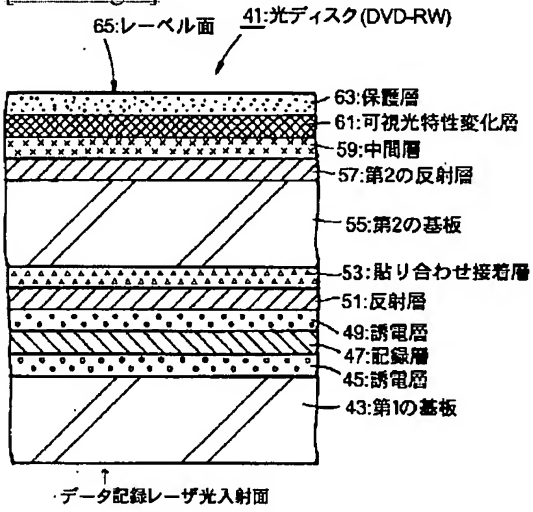
[Drawing 6]



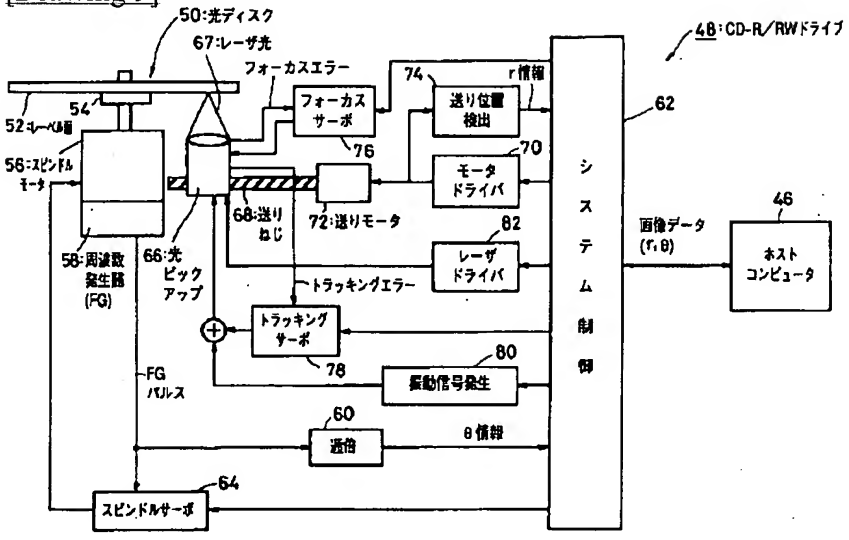
[Drawing 7]



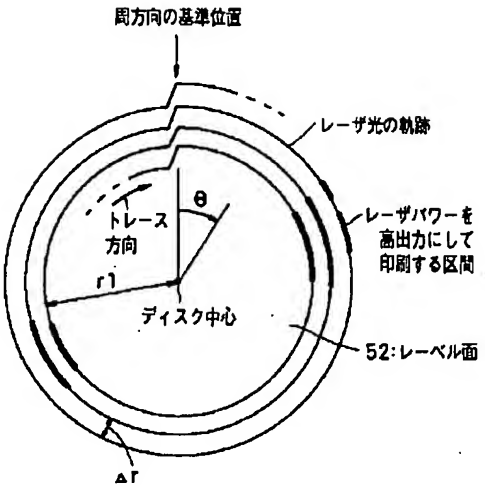
[Drawing 8]



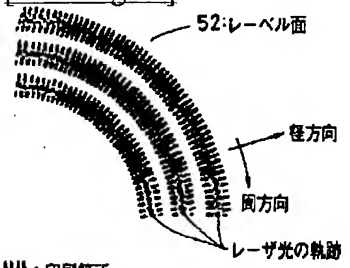
[Drawing 9]



[Drawing 10]



[Drawing 13]



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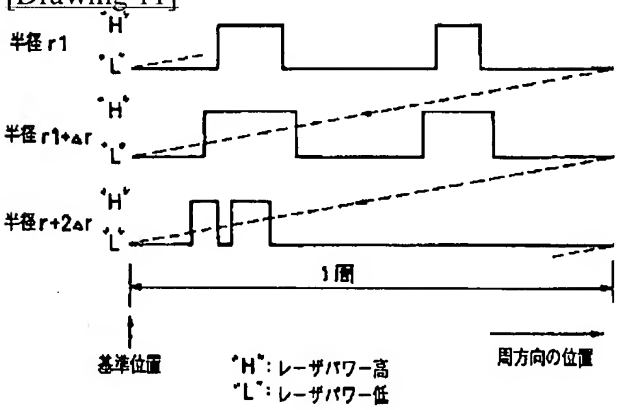
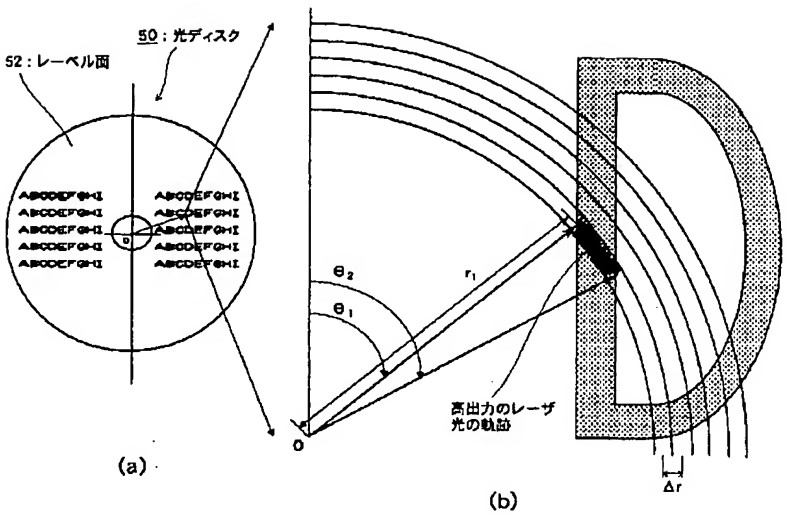
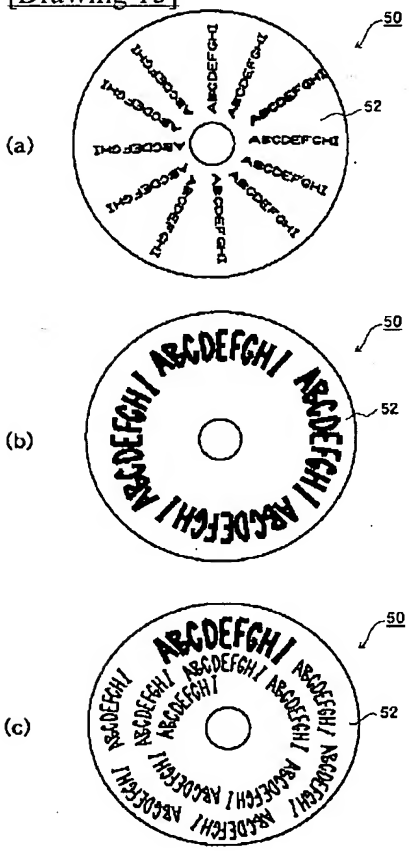
[Drawing 11]



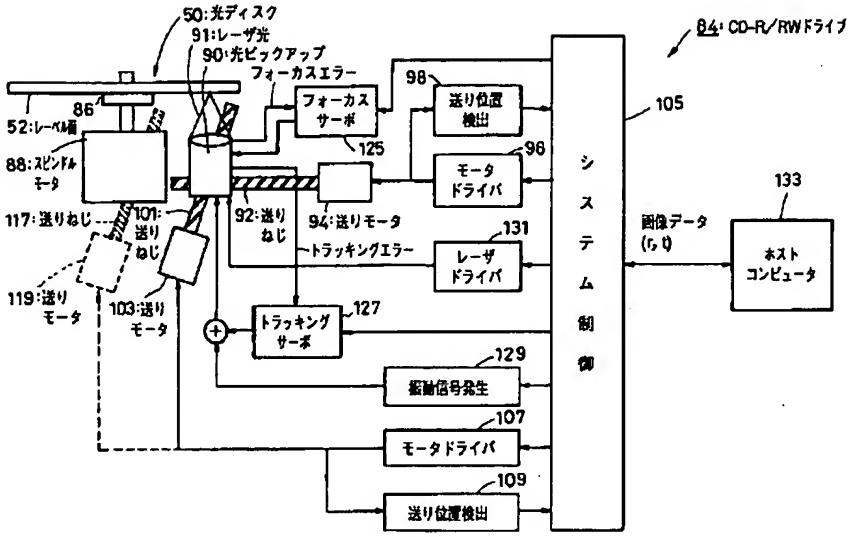
[Drawing 14]



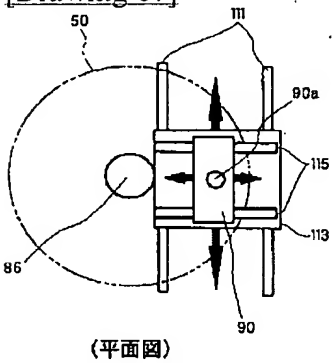
[Drawing 15]



[Drawing 16]



[Drawing 17]



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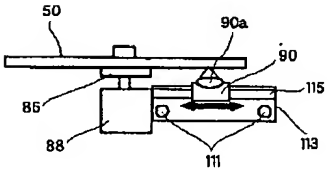

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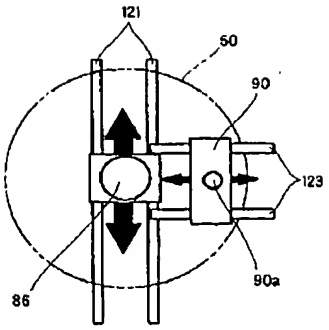
[Drawing 18]



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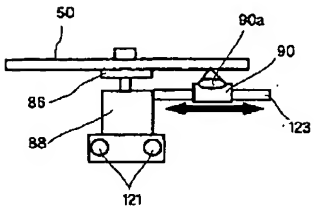

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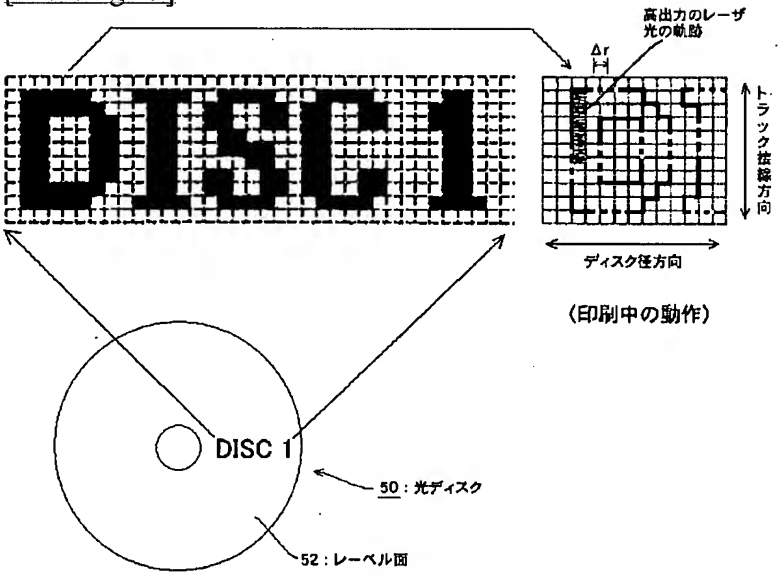
[Drawing 19]



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[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention enables it to perform image formation to a labelled surface about an optical disk at the labelled surface image formation approach and optical disk unit list of an optical disk using the laser beam of an optical disk unit.
[0002]
[Description of the Prior Art] In a recordable mold optical disk, the information (title etc.) about the contents of record is attached and written down in an optical disk by the user so that the contents recorded on the optical disk can be checked visually. In this case, generally in the one side optical disk treated with a disk simple substance, without holding in cartridges, such as CD system optical disk {CD-R (CD recorder bull), CD-RW (CD lilac ITABURU), etc.}, writing in the labelled surface of an optical disk with a direct pen is performed. Moreover, editing the information about the contents of record on a personal computer as an option, printing it on a label by the printer, and sticking on a labelled surface is also performed.
[0003]
[Problem(s) to be Solved by the Invention] When it wrote to the labelled surface of a disk by the strong force in the approach of writing in with a direct pen using the hard pen etc., its recording layer might be hurt. Moreover, the printer was required of the approach of printing on a label by the printer separately. This invention was made in view of the above-mentioned point, and as it can perform image formation to a labelled surface using the laser beam of an optical disk unit, it tends to provide with an optical disk the labelled surface image formation approach and optical disk unit list of an optical disk which made unnecessary printing by writing with a pen, or the printer.
[0004]
[Means for Solving the Problem] The labelled surface image formation approach of this invention in the part which is in sight from the labelled surface side of an optical disk the exposure of the laser beam from this labelled surface side -- the light property {color (a hue --) from this labelled surface side The light property change layer from which}, such as lightness, saturation, spectrum, a reflection factor, permeability, and light scattering, changes is formed. Turn the labelled surface to a laser beam incidence side, and said optical disk is set to the turntable of an optical disk unit. The laser beam by which outgoing radiation is carried out is made displaced relatively along the field of this optical disk from said optical disk and said optical pickup. The laser beam by which outgoing radiation is carried out from said optical pickup synchronizing with this relative displacement According to image data which is going to carry out image formation, such as an alphabetic character and a picture, it becomes irregular, said light property change layer is irradiated from said labelled surface side, the light property of this light property change layer is changed by this exposure, and the image applicable to this labelled surface is formed. Since images which the laser beam of an optical disk unit is irradiated at the light property change layer formed in the part which is in sight from the labelled surface side of an optical disk, and the light property of this layer is changed, and correspond to this labelled surface, such as an alphabetic character and a picture, were formed according to this labelled surface image formation approach, writing with a pen and printing by the printer can be made unnecessary.
[0005] The labelled surface image formation approach of this invention can make said laser beam the laser beam more than predetermined power, for example. Moreover, said optical pickup can be moved in the direction of a path of this optical disk, rotating said optical disk. Moreover, said optical disk can be made to be able to stand it still, and said optical pickup can also be moved to the truck tangential direction which goes in

the direction of a path of this optical disk, and the direction of a path of this optical disk direct.
[0006] The relative-displacement device in which the laser beam by which outgoing radiation is carried out is made displaced relatively along the field of this optical disk from the optical disk which the optical disk unit of this invention turned the labelled surface to the turntable at the laser beam incidence side, and was set, and an optical pickup, The laser modulation circuit which modulates the laser beam by which outgoing radiation is carried out from said optical pickup, Said relative-displacement device and control circuit of said laser modulation circuit are provided. Said control circuit Control said relative-displacement device and said optical disk and said laser beam are made displaced relatively. According to image data which is going to carry out image formation to the labelled surface of this relative displacement and this optical disk, such as an alphabetic character and a picture, control said laser modulation circuit, and the laser beam by which outgoing radiation is carried out from said optical pickup is modulated by this image data. Control which carries out image formation of the corresponding image to the light property change layer which was formed in the part which is in sight from the labelled surface side of this optical disk, and from which a light property changes with the exposures of said laser beam is performed. According to this optical disk unit, the labelled surface image formation approach of this invention can be enforced.
[0007] The rotation driving gear with which for example, the aforementioned relative-displacement device carries out the rotation drive of the turntable, and the direction delivery driving gear of a path made to move said optical pickup in the direction of a path of said optical disk shall be provided, said control circuit shall control both [these] driving gears, and the optical disk unit of this invention shall control relative displacement with said optical disk and said laser beam. In this case, said control circuit shall drive said rotation driving gear to rotational frequency regularity, and shall carry out the specified quantity drive of said direction delivery driving gear of a path for every predetermined rotation location. Moreover, the hoop direction location detection equipment which detects the hoop direction location of said optical disk, and the direction location detection equipment of a path which detect the direction location of the diameter of an optical disk of this optical pickup provide further, and the control which said control circuit modulates according to image data which is going to carry out image formation of the laser beam by which outgoing radiation is carried out from said optical pickup to the detection location of both [these] locations detection equipment and the labelled surface of said optical disk, such as an alphabetic character and a picture, shall perform. Moreover, the positional information of said image data shall be expressed by the coordinate data based on the combination of an optical disk hoop direction location and the direction location of the diameter of an optical disk. Moreover, the frequency generator which said hoop direction location detection equipment rotates with said rotation driving gear, and generates the signal of the frequency according to the rotation, and the multiplier which carries out multiplying of the frequency of the signal generated from this frequency generator shall be provided. Moreover, the direction delivery driving gear of a path which said relative-displacement device makes move said optical pickup in the direction of a path of said optical disk, and the truck tangential direction delivery driving gear made to move this optical pickup to the truck tangential direction of said optical disk which goes in the migration direction of this path direction direct shall be provided, said control circuit shall control both [these] driving gears by the condition of having made said turntable standing it still, and relative displacement of said optical disk and said laser beam shall be controlled. Moreover, the direction location detection equipment of a path which detects the direction location of the diameter of an optical disk of said optical pickup, The truck tangential direction location detection equipment which detects the optical disk-track tangential direction location which goes in the migration direction of this diameter direction of an optical disk of this optical pickup direct is provided further. Control which said control circuit modulates according to image data which is going to carry out image formation of the laser beam by which outgoing radiation is carried out to the detection location of both [these] locations detection equipment and the labelled surface of said optical disk, such as an alphabetic character and a picture, from said optical pickup shall be performed. Moreover, the positional information of said image data shall be expressed by the coordinate data based on the combination of the direction location of the diameter of an optical disk, and the optical disk-track tangential direction location which goes in the migration direction of this diameter direction of an optical disk of said optical pickup direct. Moreover, said control circuit shall turn off a tracking servo, shall turn on or turn off a focus servo, and relative displacement of said optical disk and said laser beam shall be performed. Moreover, said control circuit shall perform control which carries out the oscillating drive of the tracking actuator of said optical pickup, while performing relative displacement of said optical disk and said laser beam. Moreover, the optical disk unit of this invention can be used as the optical disk

recording apparatus of two-sheet substrate lamination optical disks, such as DVD system optical disks, such as an optical disk recording apparatus of one side optical disks, such as CD system optical disks, such as CD-R and CD-RW, or DVD-R (DVD recorder bull), and DVD-RW (DVD Re-writable).
[0008] The optical disk of this invention comes to form at one the light property change layer from which the light property from this labelled surface side changes with the exposures of the laser beam from this labelled surface side in the part which is in sight from a labelled surface side. According to this optical disk, the labelled surface image formation approach of this invention can be enforced. Moreover, since the light property change layer is formed in ********** at one, compared with a label pasting method, oscillating generating at the time of the high-speed rotation by mass eccentricity can be prevented, and failure generating by label exfoliation within a drive can be prevented.
[0009] The optical disk of this invention can use said light property change layer as the color change layer of a hue, lightness, and the saturation from which either changes at least by the exposure of said laser beam, for example. Moreover, said color change layer can be used as a sensitization layer or a sensible-heat layer. Moreover, color change layers (a sensitization layer, sensible-heat layer, etc.) are made a two-layer configuration, two-layer [this] is united or mixed by the exposure of a laser beam, and a light property can change. Moreover, said optical disk should carry out sequential membrane formation of a recording layer, a reflecting layer, and the protective layer at least on the substrate, and said light property change layer should be formed between this reflecting layer and this protective layer. Moreover, an interlayer can be stationed between said reflecting layer and said light property change layer. An interlayer can consist of ingredients which raise the adhesion of said reflecting layer and said light property change layer, adiathermic, etc., for example. Moreover, the formed image can also be made legible by constituting an interlayer from a light-scattering layer with a translucent light-scattering property. Moreover, between said reflecting layers and said protective layers, it should be minutely mixed by the part in which said light property change layer exists, and the part by which this light property change layer cannot be found and these protective layers are directly joined to this reflecting layer, and it should be formed. Since a reflecting layer and protective layers have the part joined directly, adhesion can be made good. Moreover, since it can let the part by which there is none of these light property change layers, and these protective layers are directly joined to this reflecting layer pass and a reflecting layer can be partially desired from a labelled surface side even if a light property change layer is opaque, a focus can be easily doubled with this reflecting layer at the time of the image formation of a labelled surface. The structure where the part in which a light property change layer exists, and the part by which this light property change layer cannot be found and these protective layers are directly joined to this reflecting layer were formed by being mixed minutely For example, this light property change layer is formed much punctiforms or in the shape of [much] a hole opening between this reflecting layer and this protective layer, and it can realize as that to which this reflecting layer and this protective layer were directly joined by the outside of this point, or the inside of this hole. It can also constitute a concentric circle besides the shape of punctiform and a hole opening, in the shape of [linear] stripes, etc. The 2nd reflecting layer shall be arranged between said light property change layers and said reflecting layers, and, as for the optical disk of this invention, the detached core to separate shall be arranged in both [these] reflecting layers between said reflecting layer and said 2nd reflecting layer. If it does in this way, the effect which the heat at the time of data logging has on a light property change layer, and the effect which the heat at the time of the image formation of a labelled surface has on a recording layer can be suppressed more certainly. As for the optical disk of this invention, said optical disk shall come at least to carry out laminating arrangement of the 2nd reflecting layer and said light property change layer at the front-face side of the near substrate to which laminating arrangement of a recording layer and the reflecting layer is carried out at least between two substrates and which this reflective film faces. In this case, an interlayer can also be stationed between said 2nd reflecting layer and said light property change layer. An interlayer can consist of ingredients which raise the adhesion of said reflecting layer and said light property change layer, adiathermic, etc., for example. Moreover, an interlayer can also consist of light-scattering layers with a translucent light-scattering property. Moreover, the optical disk of this invention can be used as reflective mold recordable mold one side optical disks, such as two-sheet substrate lamination optical disks, such as DVD system optical disks, such as CD system optical disks, such as CD-R and CD-RW, or DVD-R, and DVD-RW, or the optical disk of other specification.
[0010]
[Embodiment of the Invention] The gestalt of implementation of this invention is explained below. a

fragmentary sectional view shows the gestalt of operation of the optical disk of this invention to drawing 1 (the thickness of each class -- actually -- **** -- it differs.) Moreover, illustration of a guide rail is omitted. . This shows the example which applied this invention to a CD-R disk. This optical disk 10 carries out sequential membrane formation of a pigment layer (recording layer) 14, a reflecting layer 16, the light property change layer 18, and the protective layer 20 at one side of the transparence substrates 12, such as a polycarbonate, and constitutes the whole in one. It is the same as the usual CD-R disk except there being a light property change layer 18. From a labelled surface 22 side, a light property change layer 18 can be desired through the transparent protective layer 20. The light property change layer 18 by the exposure of the laser beam more than the predetermined power from a labelled surface 22 side It is that from which the light property {a color (a hue, lightness, saturation), spectrum, a reflection factor, permeability, light scattering}, etc. from a labelled surface 22 side of the irradiated this part changes. For example, it can constitute from a layer (color change layer by the sensitization layer, a sensible-heat layer, etc.) of the ingredient from which the color of sensitization material, heat sensitizer, etc. changes and {which for example, changes from white to colored (black etc.), colored (black etc.), etc. from transparence}. When it constitutes the light property change layer 18 from a sensitization layer, to a laser beam with a wavelength of 780nm by which incidence is carried out from a labelled surface 22 side, the power of this laser beam cannot expose in less than 1mW, but can use sensitization material which exposes by 1mW or more and is discolored. Moreover, when it constitutes the light property change layer 18 from a sensible-heat layer, with less than 100 centigrades, a sensible heat is not carried out, but it is 100 centigrades or more and heat sensitizer which carries out a sensible heat and which is discolored can be used. In addition, since incidence of the laser beam is carried out from a substrate 12 side and it is almost intercepted by the reflecting layer 16 at the time of data logging of an optical disk 10, or playback, change of a light property does not produce the light property change layer 18. Moreover, as shown in drawing 2 , the light property change layer 18 can be set to the two-layer structure 18-1 and 18-2, and it can also constitute so that this two-layer 18-1 and 18-2 may be united or mixed by the exposure of a laser beam and a light property may change.

[0011] Between a reflecting layer 16 and the light property change layer 18, as shown in drawing 3 , an interlayer 24 can be formed. An interlayer 24 can consist of ingredients which raise the adhesion of a reflecting layer 16 and the light property change layer 18, adiathermic, etc. For the purpose which raises adhesion, as for an interlayer 24, the good ingredient of adhesion is used also to any of a reflecting layer 16 and the light property change layer 18. If the middle class 24 is constituted from an adiathermic ingredient, since it will be controlled that the heat at the time of data logging and the heat at the time of the image formation of a labelled surface conduct to the opposite side mutually, the effect which the heat at the time of data logging has on a light property change layer, and the effect which the heat at the time of the image formation of a labelled surface has on a recording layer can be suppressed. moreover, when the reflecting layer 16 and the light property change layer 18 have touched directly Although the heat at the time of the image formation of a labelled surface spreads in the direction of a field through a reflecting layer 16 (it consists of metals in many cases), the change effectiveness of the light property of the light property change layer 18 falls or there is a possibility that an image may spread and may be formed If the middle class 24 is constituted from an adiathermic ingredient, it is controlled that the heat at the time of the image formation of a labelled surface spreads in the direction of a field through a reflecting layer 16, and it can prevent decline in the change effectiveness of a light property, and a blot of an image. By constituting an interlayer 24 from a light-scattering layer with a translucent light-scattering property, the formed image can also be made legible. It can replace with preparing an interlayer as the technique of raising the adhesion of a reflecting layer 16 and the light property change layer 18, and the light property change layer 18 can be formed in much detailed punctiforms (for example, the circular or comparable magnitude whose diameter of one point is about several 10 micrometers is un-circular) as shown in drawing 4 (for example, it forms using techniques, such as a film imprint.). moreover, the hole which has many detailed holes 26 as it replaces with much detailed punctiforms and is shown in drawing 5 -- it can form in the shape of an opening. When it forms in the punctiform of drawing 4 , it is the outside of a point, and when it forms in the shape of [of drawing 5] a hole opening, it is the inside of a hole, and since protective layer 20 are directly joined to the reflecting layer 16, adhesion can be made good. Moreover, since it can let the part by which there is no light property change layer 18, and protective layer 20 are directly joined to the reflecting layer 16 pass and a reflecting layer 16 can be partially desired from a labelled surface 22 side even if the light property change layer 18 is opaque, a focus can be easily doubled with a reflecting layer 16 at the time of the image formation of a labelled surface 22. It can also constitute a concentric circle besides the shape of punctiform and

a hole opening, in the shape of [linear] stripes, etc.
[0012] a fragmentary sectional view shows the gestalt of other operations of the optical disk of this invention to drawing 6 (the thickness of each class -- actually -- **** -- it differs.) Moreover, illustration of a guide rail is omitted. . This shows the example applied to this invention to a CD-RW disk. On one side of the transparence substrates 30, such as a polycarbonate, this optical disk 28 carries out sequential membrane formation of a dielectric layer 32, a recording layer 34, a dielectric layer 36, a reflecting layer 38, the light property change layer 40, and the protective layer 42, and constitutes the whole at one. It is the same as the usual CD-RW disk except there being a light property change layer 40. From a labelled surface 44 side, a light property change layer 40 can be desired through the transparent protective layer 42. The light property change layer 40 can be constituted similarly to the light property change layer 18 of the gestalt of operation of drawing 1 . Moreover, the interlayer who raises adhesion between a reflecting layer 38 and a protective layer 42 like drawing 3 can be stationed. moreover, the hole which has many detailed holes like drawing 5 in forming the light property change layer 40 in much detailed punctiforms like drawing 4 -- it can form in the shape of an opening, or can form a concentric circle, in the shape of [linear] stripes, etc. a fragmentary sectional view shows the gestalt of other operations of the optical disk of this invention to drawing 7 (the thickness of each class -- actually -- **** -- it differs.) Moreover, illustration of a guide rail is omitted. . This carries out laminating arrangement of a detached core 35, the 2nd reflecting layer 37, and the interlayer 39 between a reflecting layer 38 and the light property change layer 40 in the CD-RW disk 28 of drawing 6 . The 2nd reflecting layer 37 can consist of a metal layer, a dielectric reflecting layer, etc. Since the detached core 35 which consists of resin by which reflecting layers 37 and 38 are formed independently of the object for image formation and the object for data logging of a labelled surface, and intervene among both the reflecting layers 37 and 38 functions as a buffer layer to heat conduction according to this, the heat at the time of the image formation of the effect which the heat at the time of data logging has on a light property change layer, and a labelled surface can suppress more certainly the effect which it has on a recording layer. An interlayer 39 can consist of ingredients (it is the good ingredient of adhesion also to any of a reflecting layer 37 and the light property change layer 40) which raise the adhesion of a reflecting layer 37 and the light property change layer 40. Moreover, if the middle class 39 is constituted from an adiathermic ingredient, it is controlled that the heat at the time of the image formation of a labelled surface spreads in the direction of a field through a reflecting layer 37, and it can prevent decline in the change effectiveness of a light property, and a blot of an image. Moreover, the formed image can also be made legible by constituting an interlayer 39 from a light-scattering layer with a translucent light-scattering property. a fragmentary sectional view shows the gestalt of other operations of the optical disk of this invention to drawing 8 (the thickness of each class -- actually -- **** -- it differs.) Moreover, illustration of a guide rail is omitted. . This applies this invention to the DVD-RW disk of the one layer record of one side. This optical disk 41 carries out sequential membrane formation of a dielectric layer 45, a recording layer 47, a dielectric layer 49, and the reflecting layer 51, and sticks the 2nd substrate 55 (usually transparence substrate) of 0.6mm thickness, such as a polycarbonate, on one side of the 1st transparent substrate 43 of 0.6mm thickness, such as a polycarbonate, by the lamination glue line 53 on a reflecting layer 51 further. The laminating of the 2nd reflecting layer 57, an interlayer 59, the light property change layer 61, and the protective layer 63 is carried out to the front face of the 2nd substrate 55 one by one. The field by the side of a protective layer 63 constitutes a labelled surface 65. Record of data is performed by irradiating a laser beam from the front-face side of the 1st substrate 43 at a recording layer 47. Image formation of a labelled surface 65 is performed by irradiating a laser beam from a labelled surface 65 side at the light property change layer 61. The 2nd reflecting layer 57 can consist of a metal layer, a dielectric reflecting layer, etc. An interlayer 59 can consist of ingredients (it is the good ingredient of adhesion also to any of a reflecting layer 57 and the light property change layer 61) which raise the adhesion of the 2nd reflecting layer 57 and the light property change layer 61. Moreover, if the middle class 59 is constituted from an adiathermic ingredient, it is controlled that the heat at the time of the image formation of a labelled surface spreads in the direction of a field through a reflecting layer 57, and it can prevent decline in the change effectiveness of a light property, and a blot of an image. Moreover, the formed image can also be made legible by constituting an interlayer 59 from a light-scattering layer with a translucent light-scattering property.
[0013] The gestalt of operation of the optical disk unit of this invention is shown in drawing 9 (only the part which participates in the image formation of a labelled surface is shown.). This is constituted as CD-R / a RW drive (optical disk recording device in which a CD-R disk, CD-RW disc data record, and data playback are possible) used connecting with the host computers 46, such as a personal computer. In CD-R / RW drive 48, the

optical disk 50 (the CD-R disk 10 of drawing 1 - drawing 5 , CD-RW disk 28 grade of drawing 6) of this invention makes a front flesh side reverse, it is laid in a turntable (placing a labelled surface 52 upside down) 54, and a rotation drive is carried out with a spindle motor 56. With the revolving shaft of a spindle motor 56, the frequency generator 58 (FG) is linked directly, and a pulse signal (FG pulse) is generated from the frequency generator 58 for every angle of rotation to which predetermined carried out integer partition of one rotation of a spindle motor 56. Multiplying of the FG pulse is carried out to a multiple predetermined with the multiplier 60 which consists of PLL circuits etc., it is inputted into the system control circuit (CPU) 62, and is used for detection of a disk hoop direction location. the rotational frequency to which a spindle motor 56 is directed from the system control circuit 62 based on FG pulse when the spindle servo circuit 64 performs image formation of a labelled surface -- a rotational frequency -- it controls uniformly.

[0014] Under the optical disk 50, the optical pickup 66 which performs data logging, data playback, and image formation to a labelled surface is arranged. By the feed screw 68, the optical pickup 66 is supported free [migration in the direction of a path of an optical disk 50]. An optical pickup 66 is transported in the direction of a path of an optical disk 50 by driving the delivery motor 72 through Motor Driver 70, and rotating a feed screw 68 by the command of the system control circuit 62. The direction location of the diameter of an optical disk of an optical pickup 66 is detected by the delivery position transducers 74, such as a linear scale. By the command of the system control circuit 62, based on a focal error signal, the focus servo circuit 76 drives the focal actuator of an optical pickup 66, and performs focal control. When performing image formation of a labelled surface, the focus servo circuit 76 is turned on. At the time of record of data, or playback, based on a tracking error signal, the tracking servo circuit 78 drives the tracking actuator of an optical pickup 66, and performs tracking control by the command of the system control circuit 62. When performing image formation of a labelled surface, the tracking servo circuit 78 is turned off. When performing image formation of a labelled surface, the oscillating signal generating circuit 80 generates a predetermined oscillating signal by the command of the system control circuit 62, and is supplied to a tracking actuator. Thereby, the objective lens of an optical pickup 66 vibrates to radial [of an optical disk 50], the sweep spacing of the laser beam for every circumference is buried, and an image without a crevice is obtained.

[0015] By the command of the system control circuit 62, a laser driver 82 drives the laser diode of an optical pickup 66, irradiates a laser beam at an optical disk 50, and performs data logging, data playback, and image formation of a labelled surface. Namely, a laser diode carries out outgoing radiation of the laser beam of the record power modulated by the record signal at the time of data logging. The alphabetic character which outgoing radiation of the laser beam of fixed playback power tends to be carried out at the time of data playback, and is going to carry out image formation of the time of the image formation of a labelled surface, Outgoing radiation of the laser beam (laser beam used as the low power which it becomes [power] the high power which makes the light property of a light property change layer produce change in the part which carries out image formation, and does not make the light property of a light property change layer produce change in the part which does not carry out image formation) modulated by image data, such as a picture, is carried out. When performing image formation of a labelled surface, image data which was edited by the user and which is going to carry out image formation, such as an alphabetic character and a picture, is sent to CD-R / RW drive 48 from a host computer 46. This image data consists of data (for example, data which specified the image formation section expressed with an include angle theta to every [of predetermined pitch deltar] radius location r) expressed with the coordinate (r, theta) by the combination of the direction location r of a path of an optical disk (distance from the center of rotation), and the hoop direction location theta (include angle of the hoop direction to a proper criteria location).

[0016] The image formation process of the labelled surface of the optical disk 50 by CD-R / RW drive 48 of drawing 9 is performed as follows, for example.

(1) Make an optical disk 50 into data logging, or the time of playback and table back reverse, and equip a turntable 54 with it.

(2) A user edits images which carry out image formation, such as an alphabetic character and a picture, on the display of a host computer 46. A host computer 46 changes the edited image into image data.

(3) A user directs initiation of image formation actuation on a host computer 46.

(4) The spindle servo circuit 64 carries out CAV (rotational frequency regularity) control of the spindle motor 56 so that the pulse generated from the frequency generator 58 may serve as a fixed frequency ordered in the system control circuit 62.

(5) Position an optical pickup 66 in the criteria location of the predetermined direction of a path by the side of the inner circumference of an optical disk 50.
(6) A laser driver 82 drives this laser diode so that the laser power of the laser diode of an optical pickup 66 may serve as predetermined low-power output (the light property of a light property change layer does not change, focal control is a possible value, for example, it is the value of 1mW or less) ordered in the system control circuit 62.
(7) Turn on the focus servo circuit 76 with directions of the system control circuit 62. Thereby, the focus servo circuit 76 applies a focus servo so that a laser beam 67 may serve as the minimum spot by the reflecting layer. In addition, the tracking servo circuit 78 presupposes that it is still off, and a tracking servo does not apply it.
(8) Preparation of image formation is completed above and start image formation with directions of the system control circuit 62. Namely, the system control circuit 62 inputs image data from a host computer 46. Proper timing based on [drive the delivery motor 72, position an optical pickup 66 in the radius location which has the first image formation part by the inner circumference side of an optical disk 50, and] FG pulse () The detection timing of the detector separately formed in order to detect the criteria location of a hoop direction or as a criteria location of a hoop direction The output pulse of a multiplier 60 is counted, the hoop direction location theta is detected, and laser power is switched to predetermined high power (it is the value from which the light property of a light property change layer changes, for example, is the value of 1mW or more) in each image formation location of the hoop direction shown by image data about this radius location. The light property of a light property change layer changes by this in the part where the laser beam of this high power was irradiated, and image formation is performed (discoloration etc.). If an optical disk 50 rotates one time and returns to the criteria location of a hoop direction, the delivery motor 62 will be driven, an optical pickup 66 will be transported in the direction of a periphery for predetermined pitch delta r minutes, laser power will be switched to predetermined high power in each image formation location of the hoop direction shown by image data about the radius location, and image formation will be performed. Henceforth, this actuation is repeated, it moves in the direction of a periphery one by one by predetermined pitch deltar for every round, and image formation is performed. Drawing 10 shows the locus of the laser beam on the labelled surface 52 of the optical disk 50 by this image formation actuation. Laser power is switched to high power in the part drawn by the thick wire, and image formation is performed. Drawing 11 shows change of the laser power when performing image formation of drawing 10 .
[0017] In addition, it moves at once to a radius location with the next image formation part, without scanning about a radius location without an image formation part, and image formation is performed. Moreover, if pitch deltar is large, as shown in drawing 12 , even if it is originally the image which should be formed in the direction of a path by being connected, a crevice will be generated and image formation will be carried out. Although it cannot be conspicuous and a crevice can be carried out if pitch deltar is made small, the number of the circumference which takes the whole labelled surface to carry out image formation will increase, and image formation will take time amount. Then, he drives a tracking actuator by the oscillating signals (a sine wave, triangular wave, etc.) generated from the oscillating signal generating circuit 80 at the time of image formation, and is trying to vibrate an objective lens in the direction of the diameter of a disk in CD-R / RW drive 48 of drawing 9 . Thereby, as shown in drawing 13 , a laser beam vibrates in the direction of the diameter of a disk, and even if pitch deltar is comparatively large, image formation without a crevice (or a crevice is small) can be performed. The frequency of an oscillating signal can be set as about several kHz. Moreover, pitch deltar can be set as about 50-100 micrometers.
[0018] (a) shows the actual example of image formation of the labelled surface 52 by CD-R / RW drive 48 of drawing 9 to drawing 14 . In case this drawing (b) shows the partial enlarged drawing of the locus of the laser beam when carrying out image formation of this and scans the location of a radius r1, an include angle is the section of theta1-theta2, and it shows the condition of making laser power into high power. Drawing 15 (a), (b), and (c) show other examples of image formation of the labelled surface 52 by CD-R / RW drive 48, respectively. Image formation of text of arbitration, such as a disk title, a music name, and an artist name, the picture, etc. can be carried out.
[0019] The gestalt of other operations of the optical disk unit of this invention is shown in drawing 16 (only the part which participates in the image formation of a labelled surface is shown.). In CD-R / RW drive 84, the optical disk 50 (the CD-R disk 10 of drawing 1 - drawing 5 , CD-RW disk 28 grade of drawing 6) of this invention makes a front flesh side reverse, and is laid in the turntable (placing a labelled surface 52 upside

down) 86. When performing image formation, a spindle motor 88 is not driven. Under the optical disk 50, the optical pickup 90 which performs data logging and data playback is arranged. By the feed screw 92, the optical pickup 90 is supported free [migration in the direction of a path of an optical disk 50]. An optical pickup 90 is transported in the direction of a path of an optical disk 50 by driving the delivery motor 94 through Motor Driver 96, and rotating a feed screw 92 by the command of the system control circuit 62. The direction location of the diameter of an optical disk of an optical pickup 90 is detected by the delivery position transducers 98, such as a linear scale.

[0020] The whole is supported free [migration to a truck tangential direction (direction which intersects perpendicularly with the feed direction of the direction of the diameter of a disk)] by the feed screw 101 which the feed screw 92 and the direction delivery device of the diameter of a disk in which it had a feed screw 92 and the delivery motor 94 crossed at right angles, and was allotted in parallel with the field of a disk 50. An optical pickup 90 is transported to a truck tangential direction by driving the delivery motor 103 through Motor Driver 107, and rotating a feed screw 101 by the command of the system control circuit 105. The location of the truck tangential direction of an optical pickup 90 is detected by the delivery position transducers 109, such as a linear scale.

[0021] The example of arrangement of a delivery device is shown in drawing 17 (not shown [a delivery motor and a feed screw]). Fixed arrangement of the slide bar 111 is carried out in parallel with the field of an optical disk 50 at MEKABESU of CD-R / RW drive 84. The optical pickup unit 113 is supported by the slide bar 111 possible [a slide]. The optical pickup unit 113 is transported along with a slide bar 111 by the delivery motor 103 and the feed screw 101 (drawing 16). It is parallel to the field of an optical disk 50, and it intersects perpendicularly with a slide bar 111, and fixed arrangement of the slide bar 115 is carried out at the optical pickup unit 113. The optical pickup 90 is supported by the slide bar 115 possible [a slide]. An optical pickup 90 is transported along with a slide bar 115 by the delivery motor 94 and the feed screw 92 (drawing 16). The delivery device of both directions drives at the time of image formation. Driving only the delivery device of the direction of the diameter of a truck at the time of record of data, or playback, it is stopped by the delivery device of a truck tangential direction in the center valve position (location where objective lens 90a of an optical pickup 90 is transported in the direction of the diameter of a disk by the drive of the delivery device of the direction of the diameter of a truck).

[0022] In addition, the delivery device of a truck tangential direction can be replaced with transporting an optical pickup 90, and can also be made into what transports a spindle motor 88. In that case, in drawing 16 , it replaces with the feed screw 101 and the delivery motor 103 which transport an optical pickup 90 to a truck tangential direction, and the feed screw 117 and the delivery motor 119 which transport a spindle motor 88 in this direction are formed. The example of arrangement of the delivery device in that case is shown in drawing 18 (not shown [a delivery motor and a feed screw]). Fixed arrangement of the slide bar 121 is carried out in parallel with the field of an optical disk 50 at MEKABESU of CD-R / RW drive 84. The spindle motor 88 is supported possible [a slide] by the slide bar 121. A spindle motor 88 is transported along with a slide bar 121 by the delivery motor 119 and the feed screw 117 (drawing 16). Fixed arrangement of the slide bar 123 is carried out at MEKABESU of CD-R / RW drive 84. The optical pickup 90 is supported by the slide bar 123 possible [a slide]. An optical pickup 90 is transported along with a slide bar 123 by the delivery motor 94 and the feed screw 92 (drawing 16). The delivery device of both directions drives at the time of image formation. Driving only the delivery device of the direction of the diameter of a truck at the time of record of data, or playback, it is stopped by the delivery device of a truck tangential direction in the center valve position (location where objective lens 90a of an optical pickup 90 is transported in the direction of the diameter of a disk by the drive of the delivery device of the direction of the diameter of a truck).

[0023] In drawing 16 , based on a focal error signal, the focus servo circuit 125 drives the focal actuator of an optical pickup 90, and performs focal control by the command of the system control circuit 105. When performing image formation of a labelled surface, the focus servo circuit 125 is turned on. At the time of record of data, or playback, based on a tracking error signal, the tracking servo circuit 127 drives the tracking actuator of an optical pickup 90, and performs tracking control by the command of the system control circuit 105. When performing image formation of a labelled surface, the tracking servo circuit 127 is turned off. When performing image formation of a labelled surface, the oscillating signal generating circuit 129 generates a predetermined oscillating signal by the command of the system control circuit 105, and is supplied to a tracking actuator. Thereby, the objective lens of an optical pickup 90 vibrates to radial [of an optical disk], the sweep spacing of

the laser beam for every circumference is buried, and an image without a crevice is obtained.
[0024] By the command of the system control circuit 105, a laser driver 131 drives the laser diode of an optical pickup 90, irradiates a laser beam at an optical disk 50, and performs data logging, data playback, and image formation of a labelled surface. A laser diode namely, by the drive of a laser driver 131 Outgoing radiation of the laser beam of the record power modulated by the record signal is carried out at the time of data logging, and outgoing radiation of the fixed laser beam is carried out by playback power at the time of data playback. At the time of the image formation of a labelled surface The laser beam modulated by image data which is going to carry out image formation, such as an alphabetic character and a picture, (it becomes the high power which makes the light property of a light property change layer produce change in the part which carries out image formation) Outgoing radiation of the laser beam used as the low power which does not make the light property of a light property change layer produce change in the part which does not carry out image formation is carried out. When performing image formation of a labelled surface, image data which was edited by the user and which is going to carry out image formation, such as an alphabetic character and a picture, is sent to CD-R / RW drive 84 from a host computer 133. This image data consists of dot-matrix data (for example, data which specified the image-formation section of the truck tangential direction expressed with t to every [of predetermined pitch deltar] radius location r) expressed with the coordinate (r, t) by the combination of direction location [of an optical disk] of path r {the distance from the proper criteria location (for example, center of rotation) of the direction of the diameter of a disk}, and the truck tangential direction location t (distance from the proper criteria location of a truck tangential direction).
[0025] The image formation process of the labelled surface of the optical disk 50 by CD-R / RW drive 84 of drawing 16 is performed as follows, for example.
(1) Make an optical disk 50 into data logging, or the time of playback and table back reverse, and equip a turntable 86 with it.
(2) A user edits images which carry out image formation, such as an alphabetic character and a picture, on the display of a host computer 133. A host computer 133 changes the edited image into image data.
(3) A user directs initiation of image formation actuation on a host computer 133.
(4) An image formation working halt of the spindle motor 88 is carried out by directions of the system control circuit 105.
(5) Position an optical pickup 90 in a predetermined criteria location.
(6) A laser driver 131 drives this laser diode so that the laser power of the laser diode of an optical pickup 90 may serve as predetermined low-power output (the light property of a light property change layer does not change, focal control is a possible value, for example, it is the value of 1mW or less) ordered in the system control circuit 105.
(7) Turn on the focus servo circuit 125 with directions of the system control circuit 105. Thereby, the focus servo circuit 125 applies a focus servo so that a laser beam may serve as the minimum spot 91 by the reflecting layer. In addition, the tracking servo circuit 127 presupposes that it is still off, and a tracking servo does not apply it.
(8) Preparation of image formation is completed above and start image formation with directions of the system control circuit 105. Namely, the system control circuit 105 inputs image data from a host computer 133. Drive the delivery motor 94 and an optical pickup 90 is positioned in the direction location of the diameter of a disk which has the first image formation part by the inner circumference side of an optical disk 50. Drive a motor 103 (or 119) in the direction location of the diameter of a disk, and a laser beam is moved to a truck tangential direction. Laser power is switched to predetermined high power (it is the value from which the light property of a light property change layer changes, for example, is the value of 1mW or more) over the image formation section of the truck tangential direction shown by image data about the direction location of the diameter of a disk. The light property of a light property change layer changes by this in the part where the laser beam of this high power was irradiated, and image formation is performed (discoloration etc.). Then, driving the delivery motor 94, transporting an optical pickup 90 in the direction of a periphery for predetermined pitch delta r minutes, and transporting to a truck tangential direction in the location, laser power is switched to predetermined high power over the image formation section of the truck tangential direction shown by image data about the direction location of the diameter of a disk, and image formation is performed. Henceforth, this actuation is repeated, it moves in the direction of a periphery one by one by predetermined pitch deltar, and image formation is performed. Drawing 19 shows the locus and the done image of a laser beam on the labelled

surface 52 of the optical disk 50 by this image formation actuation. Since a laser beam moves vibrating with an oscillating signal, an image without a crevice (or a crevice is small) is obtained.

[0026] In addition, with the gestalt of said operation, although the light property change layer has been arranged between a reflecting layer and a protective layer, the optical disk of this invention cannot be restricted to this, and can arrange a light property change layer in one which is visible from the labelled surface side of an optical disk of parts (for example, on a protective layer). Moreover, although the gestalt of said operation explained the case where image formation was performed to the optical disk of this invention with which the light property change layer was constituted by one, the image formation by the labelled surface image formation approach or optical disk unit of this invention is not restricted to this. That is, with the application of the labelled surface image formation approach or optical disk unit of this invention, image formation can also be performed about the optical disk which stuck on the labelled surface the label with which the light property change layer was constituted. Moreover, although it was made to perform image formation to a labelled surface with the gestalt of said operation, applying a focus servo, when not requiring resolution of an image, image formation can also be performed without applying a focus servo. In that case, since the reflected light required for a focus servo does not need to be obtained, a light property change layer can be formed in the opaque condition that can space a reflecting layer and it cannot be seen. Moreover, although the power of a laser beam is modulated according to image data and it was made to perform image formation with the gestalt of said operation, if there is a parameter which can give change to the light property of a light property change layer by becoming irregular according to image data with the parameter of laser beams other than power, this parameter can be modulated and image formation can also be performed. Moreover, the change gestalt of the light property of a light property change layer should just be change which can be recognized not only in what was mentioned above, but visually. Moreover, with the gestalt of said operation, although it was made to carry out image formation to the periphery side one by one from the disk inner circumference side, it does not restrict to this, and image formation can be carried out to an inner circumference side one by one from a periphery side, or, in addition to this, proper sequence can perform image formation. Moreover, although the gestalt of said operation explained the case where image formation was performed on a CD-R disk or a CD-RW disk, this invention can be applied also when performing image formation to other optical disks. Moreover, although the gestalt of said operation showed the case where this invention was applied to the optical disk unit used connecting with a host computer, not only this but this invention is applicable also to the optical disk unit used with simple substances, such as CD recorder.

[Translation done.]